

FINAL REPORT

N-57
415147

NASA Grant: NAG2-6001

Principal Investigator: Dr. Doyal A. Harper

Project Title: Real Time Data/Video/Voice Uplink & Downlink for the
Kuiper Airborne Observatory

Grant Period: From 1 July 1995 – 30 June 1997 (includes one year no-cost
extension)

NAG2-6001 supported the University of Chicago's participation in "Live from the Stratosphere" (LFS), a NASA-sponsored project involving scientists, teacher, students, NASA personnel, a private company, Geoff Haines Styles Productions, and a number of science museums and schools throughout the United State. LFS was an educational outreach adventure which brought the excitement of astronomical exploration on NASA's Kuiper Airborne Observatory (KAO) to a nationwide audience of children, parents and children through live, interactive television, broadcast from the KAO at an altitude of 41,000 feet during an actual scientific observing mission.

The project encompassed three KAO flights during the fall of 1995, including a short practice mission, a daytime observing flight between Moffett Field, California to Houston, Texas, and a nighttime mission from Houston back to Moffett Field. The University of Chicago infrared research team participated in planning the program, developing auxiliary materials including background information and lesson plans, developing software which allowed students on the ground to control the telescope and on-board cameras via the Internet from the Adler Planetarium in Chicago, and acting as on-camera correspondents to explain and answer questions about the scientific research conducted during the flights.

University of Chicago personnel participating in the flights included D.M. Cole (graduate student), R.H. Evans (Research Associate), D.A. Harper (Professor), R.F. Loewenstein (Senior Research Associate), T.J. McMahon (Engineer), J.S. Sweitzer (Outreach Coordinator), and C. Wirth (Engineer).

Products of the project include:

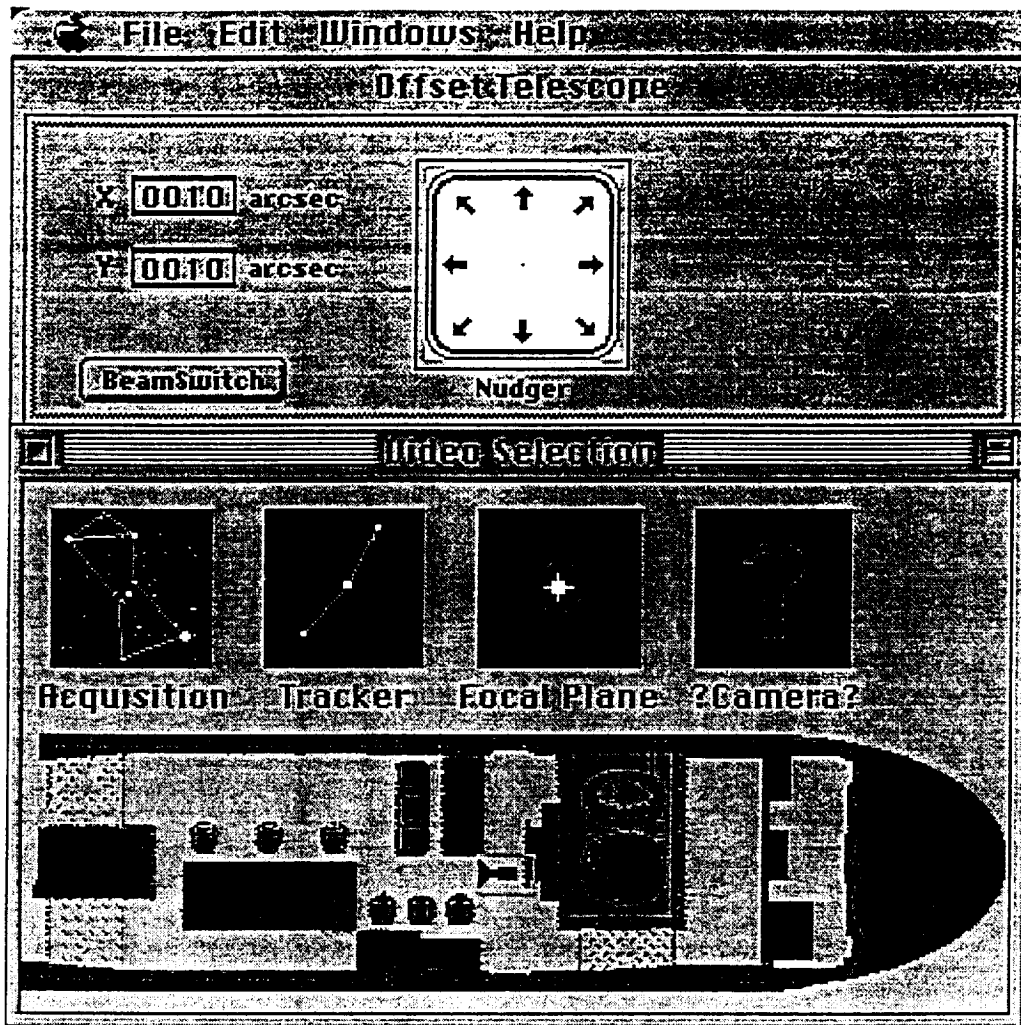
1. A professionally published coursebook including lessons introducing students to airborne and infrared astronomy and worksheets designed to allow students to analyze data from the flights.
2. Software for a graphical interface which allowed students at Adler Planetarium in Chicago to select one of five on-board cameras to view events within the aircraft cabin, to view through one of three cameras mounted on the telescope, and to actually control the KAO telescope itself during flight via an Internet connection established through NASA's ATS satellite. A screen snapshot of one of the graphical user interfaces used during the flight is shown in Figure 1.

NOV 20 1998
CASI
202A-3

3. Questions posted by students to the project Website at Ames Research Center were answered through e-mail by scientists, engineers, graduate students, technicians, and KAO flight crew members.
4. Data collected during the flights were made available on the project Website so that students could view and analyze them after the flight.
5. A professionally produced videotape which recorded and documented the project and the observing flights for use in follow-on activities and future educational programs.
6. Webpages maintained at NASA's Ames Research Center which Document the program and provide a base for ongoing and future Activities based on the LFS project.

Additional details on the program and associated reference materials may be found on these webpages: Live from the Stratosphere Homepage: <http://passport.ivv.nasa.gov/lfs/Passport> to Knowledge Live from the Stratosphere Homepage: http://passport.ivv.nasa.gov/ptk_lfs.html Hardcopies of selected pages from these websites are also included as an appendix to this report.

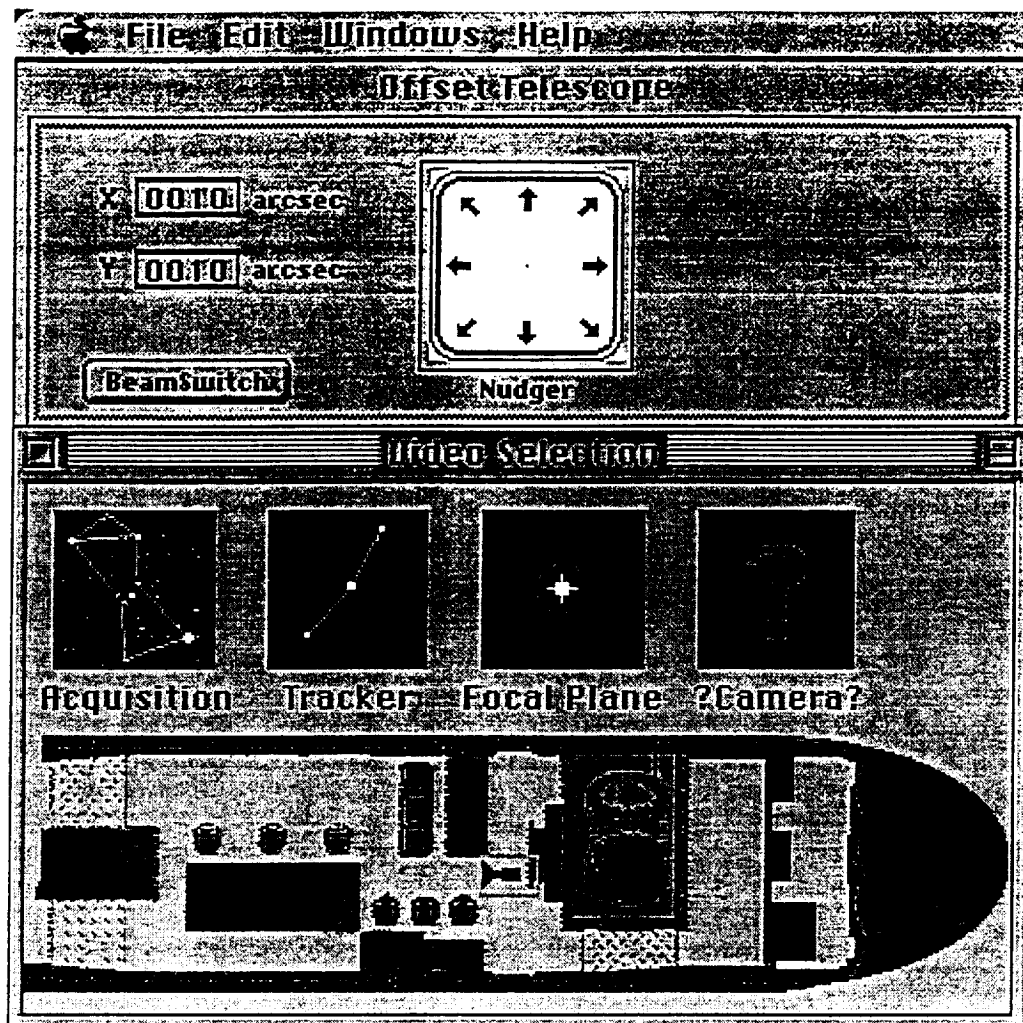
/ Figure 1.



Display of the Graphical User Interface written for the LFS flights.

The upper panel permitted small offset commands to be sent the the KAO telescope. Students could select the video view returned in a CUSeeMe window by clicking on one of the blue cameras in the KAO floorplan. A click on one of the four named boxes selected one of three cameras looking out through the various KAO telescopes or a roving camera inside the plane.

/ Figure 1.



Display of the Graphical User Interface written for the LFS flights.

The upper panel permitted small offset commands to be sent the the KAO telescope. Students could select the video view returned in a CUSeeMe window by clicking on one of the blue cameras in the KAO floorplan. A click on one of the four named boxes selected one of three cameras looking out through the various KAO telescopes or a roving camera inside the plane.



Welcome to *Live From the Stratosphere*

LIVE FROM THE STRATOSPHERE took off in Fall 1995, for the last flights of NASA's Kuiper Airborne Observatory, but the materials still provide a comprehensive resource on infrared astronomy, and what it's like to live and work 41,000 feet above the earth!

NASA's successor aircraft, SOFIA (a converted Boeing 747), is due to begin observational flights in the first years of the 21st Century.

"Researcher Q&A" is not currently Inter/Active.

Choose one of the following links below - LFS with graphics for those with graphical browsers such as Netscape or Mosaic, or a text-only version for those using programs like Lynx or having very slow Internet connectivity.

[Go To LFS \(with graphics\)](#) | [Go To LFS \(text only\)](#)

| [LFS Home](#) | [Give Us Feedback!](#) | [Tell a Friend!](#) | [LFS Overview](#) |
| [Quest Home](#) | [Search Quest](#) | [Search WWW](#) | [Quest Overview](#) | [Join Us!](#) |



Stratosphere

[Feedback](#)[Search LFS-web](#)[Quest Home](#)[Overview](#)[LFS Home](#)

Welcome to *Live From the Stratosphere*

LIVE FROM THE STRATOSPHERE took off in Fall 1995, for the last flights of NASA's Kuiper Airborne Observatory, but the materials still provide a comprehensive resource on infrared astronomy, and what it's like to live and work 41,000 feet above the earth!

NASA's successor aircraft, SOFIA (a converted Boeing 747), is due to begin observational flights in the first years of the 21st Century.

"Researcher Q&A" is not currently Inter/Active.

Choose one of the following links below - LFS with graphics for those with graphical browsers such as Netscape or Mosaic, or a text-only version for those using programs like Lynx or having very slow Internet connectivity.

[Go To LFS \(with graphics\)](#) | [Go To LFS \(text only\)](#)

| [LFS Home](#) | [Give Us Feedback!](#) | [Tell a Friend](#) | [LFS Overview](#) |
| [Quest Home](#) | [Search Quest](#) | [Search WWW](#) | [Quest Overview](#) | [Join Us!](#) |

NASA
K12

Credits & Contacts



Stratosphere

[Feedback](#)

[Search LFS-web](#)

[Quest Home](#)

[Overview](#)

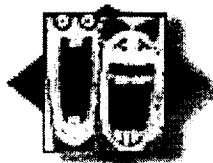
[LFS Home](#)



[About the
KAO](#)



[What's
New](#)



[KAO
People](#)



[KAO
Live](#)



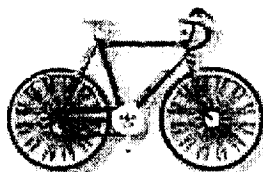
[Lots o'
Pics!](#)



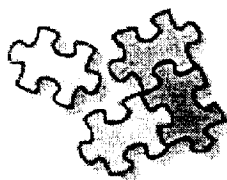
[Guides &
Resources](#)



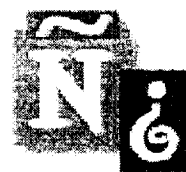
[Teachers'
Lounge](#)



[Kids'
Stuff](#)



[Collaborate:
Star Census](#)



[LFS
español](#)

NASA
LITA K12

[Credits & Contacts](#)



Stratosphere

[Feedback](#)

[Search LFS web](#)

[Guest Home](#)

[Overview](#)

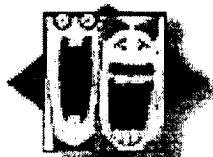
[LFS Home](#)



[About the
KAO](#)



[What's
New](#)



[KAO
People](#)



[KAO
Live](#)



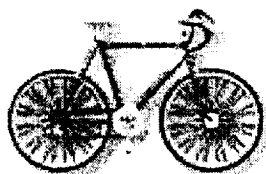
[Lots o'
Pics!](#)



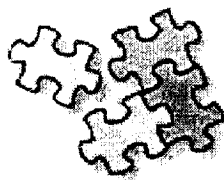
[Guides &
Resources](#)



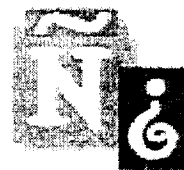
[Teachers'
Lounge](#)



[Kids'
Stuff](#)



[Collaborate-
Star Census](#)



[LFS
español](#)

NASA
K12

[Credits & Contacts](#)

Stratosphere

[Feedback](#)

[Search LFS-web](#)

[Passport Home](#)

[Overview](#)

[LFS Home](#)

About the Kuiper Airborne Observatory(KAO)

- [Who was Kuiper?](#)
- [Information about the KAO](#)
- [Take a Virtual Tour of the KAO](#)
- [KAO Career Science Highlights](#)
- [KAO's Study of Shoemaker-Levy 9](#)
- [KAO Highlights '94](#)
- [The Kuiper Home Page](#)
- [SOFIA - The KAO replacement](#)
- [Help design SOFIA](#)

[LFS Home](#) | [Give Us Feedback!](#) | [Tell a Friend](#) | [LFS Overview](#) | [Search LFS](#) | [LFS Home](#) | [Quest Home](#) | [Search Quest](#) | [Search WWW](#) | [Quest Overview](#) | [Join Us!](#)

NASA
HITL K12

Credits & Contacts



Stratosphere

[Feedback](#)[Search LFS-web](#)[Passport Home](#)[Overview](#)[LFS Home](#)

About the Kuiper Airborne Observatory(KAO)

- [Who was Kuiper?](#)
- [Information about the KAO](#)
- [Take a Virtual Tour of the KAO](#)
- [KAO Career Science Highlights](#)
- [KAO's Study of Shoemaker-Levy 9](#)
- [KAO Highlights '94](#)
- [The Kuiper Home Page](#)
- [SOFIA - The KAO replacement](#)
- [Help design SOFIA](#)


[LFS Home](#) | [Give Us Feedback!](#) | [Tell a Friend](#) | [LFS Overview](#) | [Search LFS](#) | [LFS Home](#) | [Search Quest](#) | [Search WWW](#) | [Quest Overview](#) | [Join LFS!](#)

NASA
JPL
K12

Credits & Contacts

Stratosphere

[Feedback](#)[Search LFS-web](#)[Passport Home](#)[Overview](#)[LFS Home](#)

What's  on the LFS Web

Project Evaluation

[Form for teachers](#)

[Form for students](#)

Live From the Stratosphere Project News

Thursday, December 14

You can help design SOFIA, the follow-on to the KAO. See <http://quest.arc.nasa.gov/lfs/sofia.html> for details.

Monday, November 13

Evaluation forms are now available (see above). Please take the time to send us your thoughts about this project. Your input is critical to us.

Thursday, October 26

New diagrams (from scratch) have been added to the Web which show how the


[Weekly Newsletter](#)

[Project Update Archive](#)

[LFS Home](#) | [Give Us Feedback](#) | [Tell a Friend](#) | [LFS Overview](#) | [Search LFS](#) |
[Quest Home](#) | [Search Quest](#) | [Search WWW](#) | [Quest Overview](#) | [Join Us!](#) |

Stratosphere

[Feedback](#)[Search LFS-web](#)[Passport Home](#)[Overview](#)[LFS Home](#)

What's  on the LFS Web

Project Evaluation

[Form for teachers](#)

[Form for students](#)

Live From the Stratosphere Project News

Thursday, December 14

You can help design SOFIA, the follow-on to the KAO. See <http://quest.arc.nasa.gov/lfs/sofia.html> for details.

Monday, November 13

Evaluation forms are now available (see above). Please take the time to send us your thoughts about this project. Your input is critical to us.

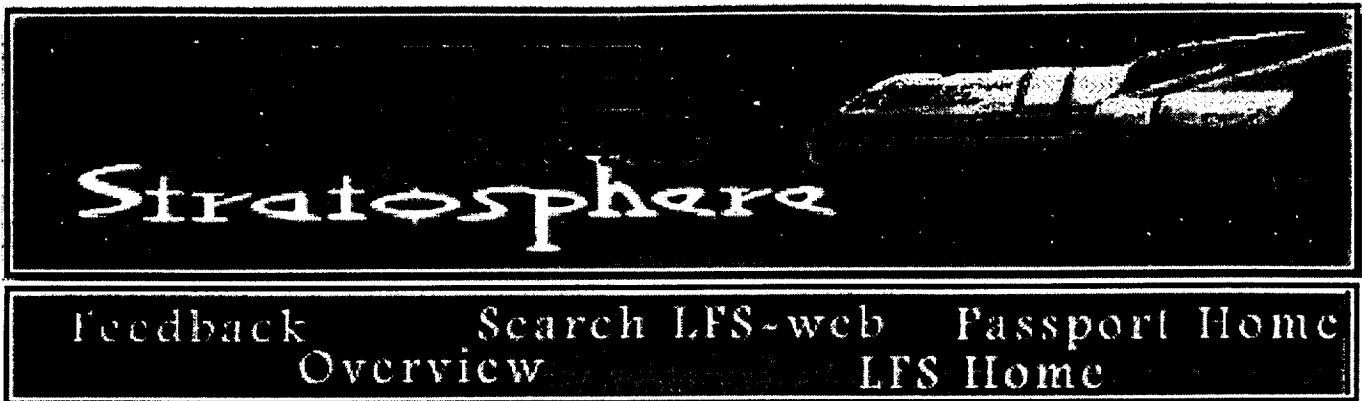
Thursday, October 26

New diagrams (most useful) have been added to the Web which show how the

[Weekly Newsletter](#)

[Project Update Archive](#)

[LFS Home](#) | [Give Us Feedback!](#) | [Tell a Friend!](#) | [LFS Overview](#) | [Search LFS!](#)
| [Quest Home](#) | [Search Quest!](#) | [Search WWW!](#) | [Quest Overview](#) | [Join Us!](#) |



Live From...the Stratosphere The People of the Kuiper Airborne Observatory

Kuiper Staff and Mission Operations

Mission Directors: [Wendy Whiting](#), [Steve Patterson](#), [Carl Gillespie](#), [Jim McClenahan](#), [Tom Kalaskey](#)

Engineers: [Paul Keas](#), [Walter Miller](#), [Mark Elston](#), [Kaiser Adami](#), [Tom Connors](#), [Paul DeLeon](#)

Telescope Operators: [Juan Rivera](#), [Rick Doll](#), [Terry Richardson](#)

Tracker Operators: [Ben Burrell](#), [Allan Meyer](#)

Computer Operators: [Jim Cockrell](#), [Dennis Kelley](#), [Terry Duncan](#), [Jeff King](#)

Technician: [Alan Dunn](#)

Flight Operations

Pilot: [Terry Rager](#), [Geary Tiffany](#), [Allan McCrary](#)

Navigator: [Gene Moniz](#)

Flight Engineer: [Bill Hoss](#)

Ground Crew: [Louie Russo](#), [Chico Rijfkoel](#), [Monte Hodges](#), [Jim Mills](#), [Mario Garcia](#), [Randy Hobbs](#), [Lee Monitz](#)

Principal Investigators, Scientists, Astronomers

[Al Harper](#), [Bob Loewenstein](#), [Ed Erickson](#), [Ann Sprague](#), [Ted Dunham](#), [Mike Haas](#), [Scott Sandford](#), [Jesse Bregman](#), [Tom Roellig](#), [Sean Colgan](#), [Jim Sweitzer](#), [Paul Harvey](#), [George Gull](#), [David Hollenbach](#), [Dan Lester](#), [Dave Cote](#)

Support team for Scientists

Hardware instrumentation engineer: [Tom McMahon](#)

SOFIA Project Development

Project Manager: [Chris Wiltsee](#)

Operations Manager: [Robert Yee](#)

Engineers: [Nans Kunz](#), [Dan Machak](#)

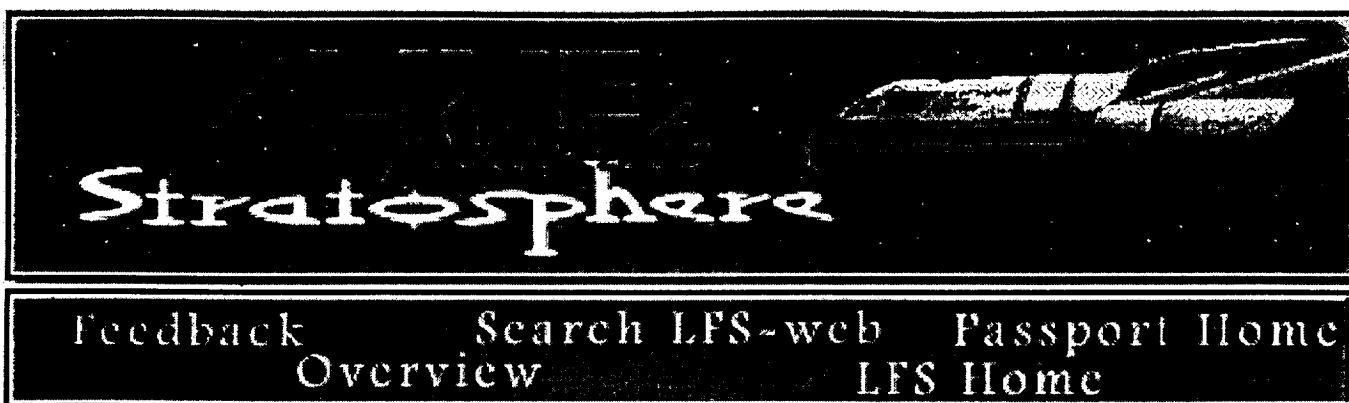
Astronomy Educators

[April Whitt](#), [Robin McGlohn](#), [Bob Conits](#), [Kurt Richter](#), [Edna DeVore](#), [Garth Hull](#), [Randy Lau](#)

[Team Members' Journals](#)

[Team Members' Junior Journals](#) (5th/6th grade reading level)

[Ask Questions of the KAO Team](#) (October 5-November 17)



Live From...the Stratosphere

The People of the Kuiper Airborne Observatory

Kuiper Staff and Mission Operations

Mission Directors: [Wendy Whiting](#), Steve Patterson, Carl Gillespie, Jim McClenahan, Tom Kalaskey

Engineers: [Paul Keas](#), [Walter Miller](#), [Mark Elston](#), [Kaiser Adeni](#), [Tom Connors](#), [Paul DeLeon](#)

Telescope Operators: [Juan Rivera](#), [Rick Doll](#), Terry Richardson

Tracker Operators: [Ben Burrell](#), [Allan Meyer](#)

Computer Operators: [Jim Cockrell](#), Dennis Kelley, Terry Duncan, Jeff King

Technician: [Alan Dunn](#)

Flight Operations

Pilot: [Terry Rager](#), Geary Tiffany, Allan McCrary

Navigator: [Gene Moniz](#)

Flight Engineer: Bill Hoss

Ground Crew: Louie Russo, Chico Rijfkoogel, Monte Hodges, Jim Mills, [Mario Garcia](#), Randy Hobbs, [Lee Moniz](#)

Principal Investigators, Scientists, Astronomers

[Al Harper](#), [Bob Loewenstein](#), Ed Erickson, Ann Sprague, [Ted Dunham](#), [Mike Haas](#), [Scott Sandford](#), Jesse Bregman, [Tom Roellig](#), [Sean Colgan](#), Jim Sweitzer, Paul Harvey, George Gull, David Hollenbach, Dan Lester, [Dave Cole](#)

Support team for Scientists

Hardware instrumentation engineer: [Tom McMahon](#)

SOFIA Project Development

Project Manager: Chris Wiltsee

Operations Manager: [Robert Yee](#)

Engineers: [Nans Kunz](#), Dan Machak

Astronomy Educators

[April Whitt](#), [Robin McGlohn](#), [Bob Conits](#), Kurt Richter, Edna DeVore, Garth Hull, Randy Lau

[Team Members' Journals](#)

[Team Members' Junior Journals](#) (5th/6th grade reading level)

[Ask Questions of the KAO Team](#) (October 5-November 17)

Stratosphere



[Feedback](#)

[Search LFS-web](#)

[Passport Home](#)

[Overview](#)

[LFS Home](#)

Live From...the Stratosphere Image Gallery

[KAO Interior Images](#)

(approx. 152k of gif previews)

[KAO Exterior Images](#)

(approx. 88k of gif previews)

[Astronomical Images](#)

(approx. 128k of gif previews)

[LFS Home](#) | [Give Us Feedback!](#) | [Tell a Friend](#) | [LFS Overview](#) | [Search LFS](#) |
[Quest Home](#) | [Search Quest](#) | [Search WWW](#) | [Quest Overview](#) | [Join Us!](#) |

NASA
JPL K12

Credits & Contacts

Stratosphere

[Feedback](#)

[Search LFS-web](#)

[Passport Home](#)

[Overview](#)

[LFS Home](#)

Live From...the Stratosphere Image Gallery

[KAO Interior Images](#)

(approx. 152k of gif previews)

[KAO Exterior Images](#)

(approx. 88k of gif previews)

[Astronomical Images](#)

(approx. 128k of gif previews)

[LFS Home](#) | [Give Us Feedback!](#) | [Tell a Friend](#) | [LFS Overview](#) | [Search LFS](#) |
[Quest Home](#) | [Search Quest](#) | [Search WWW](#) | [Quest Overview](#) | [Join Us!](#) |

NASA
IITA K12

Credits & Contacts

Stratosphere

[Feedback](#)

[Search LFS-web](#)

[Passport Home](#)

[Overview](#)

[LFS Home](#)

Live From...the Stratosphere Learning Resources

Online curriculum materials

[An Introduction to Electronic Field Trips](#) (for teachers new to the concept)

[Teacher's Guide](#) designed for this project

[Other related lesson plans](#)

[The value of the learning experience](#) (an essay)

Connecting with other people

[WebChat](#) with other people

A database of teachers who may share your interests

[Register in the LFS teacher database](#)

[Search the Database](#) (once you've registered)

Pointers to other resources

[Other related Web sites](#)

[Bibliography](#)

[LFS materials on disk](#) (look for Disk 13)

Asking the KAO team questions

[Archive of questions and answers](#)

[Asking your own questions](#) (Oct 5 to Nov 17)

[LFS Home](#) | [Give Us Feedback!](#) | [Tell a Friend](#) | [LFS Overview](#) | [Search LFS](#) |
[Quest Home](#) | [Search Quest](#) | [Search WWW](#) | [Quest Overview](#) | [Join Us!](#)

NASA
LITAK12

Credits & Contacts

Stratosphere



[Feedback](#)

[Search LFS-web](#)

[Passport Home](#)

[Overview](#)

[LFS Home](#)

Live From...the Stratosphere Learning Resources

Online curriculum materials

[An Introduction to Electronic Field Trips](#) (for teachers new to the concept)

[Teacher's Guide](#) designed for this project

[Other related lesson plans](#)

[The value of the learning experience](#) (an essay)

Connecting with other people

[WebChat](#) with other people

A database of teachers who may share your interests

[Register in the LFS teacher database](#)

[Search the Database](#) (once you've registered)

Pointers to other resources

[Other related Web sites](#)

[Bibliography](#)

[LFS materials on disk](#) (look for Disk 13)

Asking the KAO team questions

[Archive of questions and answers](#)

[Asking your own questions](#) (Oct 5 to Nov 17)

[LFS Home](#) | [Give Us Feedback!](#) | [Tell a Friend](#) | [LFS Overview](#) | [Search LFS](#) |
[Quest Home](#) | [Search Quest](#) | [Search WWW](#) | [Quest Overview](#) | [Join Us!](#) |

NASA
LITAK12

Credits & Contacts